Procedures and Guidelines

DIRECTIVE NO. 562-PG-8700.2.1 Rev A
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APPROVED BY Signature: original signed by
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TITLE: Branch Head

Responsible Office: 562 / Component Technologies and Radiation Effects Branch

Title: Radiation Hardness Assurance

1 PURPOSE

Provide various types of Radiation Hardness Assurance (RHA) support responsive to customer requests.

2 REFERENCE

GPG 8700.2 Design Development

3 SCOPE

This work instruction covers RHA support. RHA may include areas such as environmental modeling, spacecraft analysis, component analysis, radiation effects testing, and/or radiation performance. All RHA is performed with respect to radiation effects in space.

4 DEFINITIONS

a. Linear Energy Transfer (LET)- a measure of the energy deposited per unit length as an energetic particle travels through a material. The common LET unit is MeV*cm2/mg of material (Si for MOS devices, etc.).

b. Multiple Bit Upset (MBU)- an event induced by a single energetic particle such as a cosmic ray or proton that causes multiple upsets or transients during its path through a device or system.

c. Radiation Design Margin (RDM)- a factor used to increase the probability that the project will survive the environment.

d. Single Event Burnout (SEB)- a condition which can cause device destruction due to a high current state in a power transistor.

e. Single Event Effect (SEE)- any measurable effect to a circuit due to an ion strike. This includes (but is not limited to) SEUs, SHEs, SELs, SEBs, SEGRs, Single Event Functional Interrupt (SEFI, and Single Event Dielectric Rupture (SEDR).

f. Single Event Gate Rupture (SEGR)- a single ion induced condition in power MOSFETs which may result in the formation of a conducting path in the gate oxide.

g. Single Event Latchup (SEL)- a condition which causes loss of device functionality due to a single event induced high current state. An SEL may or may not cause permanent device damage, but requires power strobing of the device to resume normal device operations.

h. Single Event Upset (SEU)- a change of state or transient induced by an energetic particle such as a cosmic ray or proton in a device. This may occur in digital, analog, and optical components or may have effects in surrounding interface circuitry (a subset known as Single Event Transients (SETs). These are "soft" errors in that a reset or rewriting of the device causes normal device behavior thereafter.

i. Single Hard Error (SHE)- an SEU which causes a permanent change to the operation of a device. An example is a stuck bit in a memory device.

j. Threshold LET (LETth)- the minimum LET to cause an effect at a particle fluence of 1E7 ions/cm2. Typically, a particle fluence of 1E5 ions/cm2 is used for SEB and SEGR testing.

k. Total Ionizing Dose (TID)- cumulative long-term degradation of the device when exposed to ionizing radiation.

5 AUTHORITIES AND RESPONSIBILITIES (Not applicable for this procedure.)

6 IMPLEMENTATION

Work instructions are individualized as appropriate to meet individual customer's requirements and budget. The generic process includes the following steps:

-Obtain the Statement of Work from the customer at the beginning of the fiscal year (Unisys support for total dose testing or parts lists reviews is obtained via work requests)

-the level of support and cost of such support is negotiated. Tests are negotiated individually and the team leader keeps records regarding commitments that are agreed upon

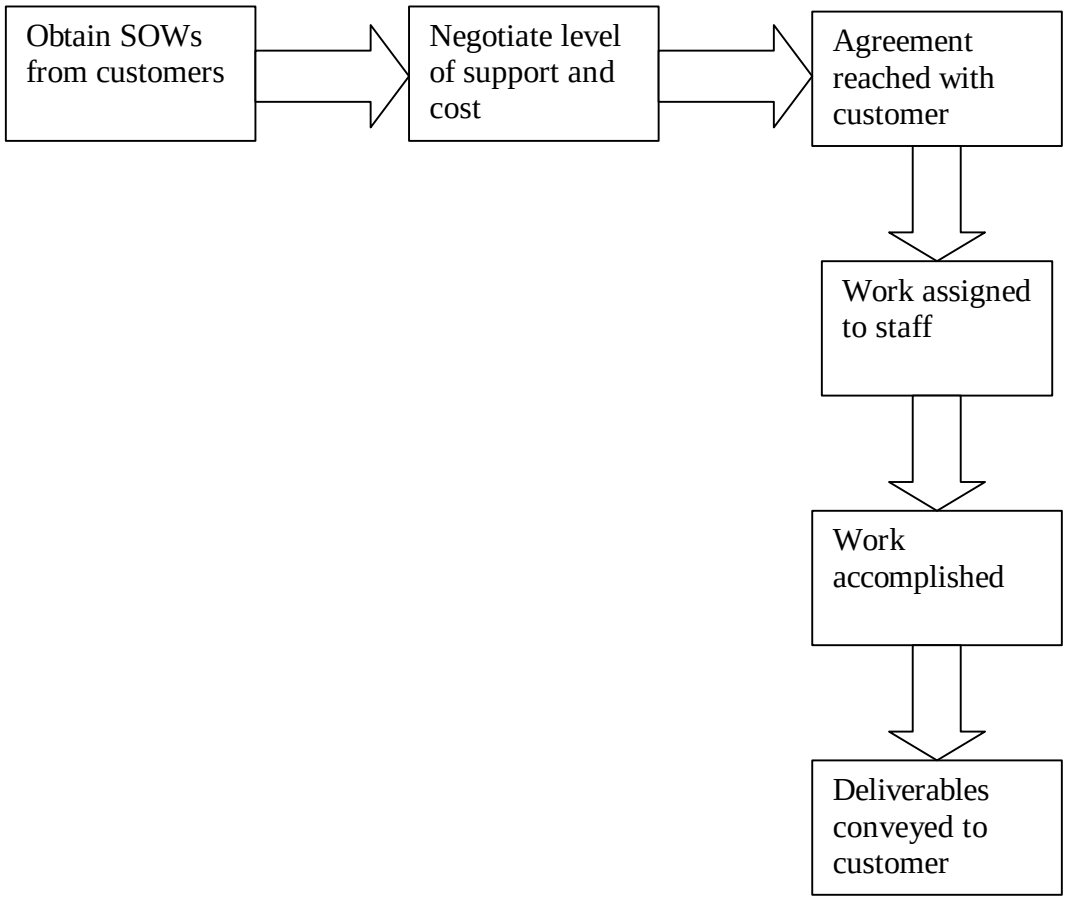
-work is assigned based on skill required and personnel availability.

-deliverables are provided as negotiated. Deliverables may include environmental analyses, definition of hazard, evaluation of hazard, definition of requirements, evaluation of device use, radiation test reports, and/or performance based specifications and requirements. The process is reiterated as necessary.

7 RECORDS

Quality Records	Record Custodian	Retention
Statement of work (SOW)	Team Leader	2 years
Agreed upon commitments	Team Leader	Retain as necessary
Deliverables	Team leader	Retain as necessary

8 FLOW DIAGRAM



CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	09/29/1998	Initial Release
A	08/09/1999	Add quality records